

Q1. [5 marks] Show whether or not $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a tautology.

Q2. Consider the following two statements:

A: You are happy but neither you have money nor a car.

B: It is not the case that if you are happy, then you have money or a car.

(a) [2 marks] Write the above two statements in symbolic forms.

(b) [4 marks] Are the two statements A and B equivalent? Justify your answer.

Q3. [8 marks] Let $G(x)$: "Student x has a GPA greater than 3.0"
 $D(x)$: "Student x has MSC degree"
 S : Set of all students.

Write the following statements in symbolic form using predicates $G(x)$, $D(x)$, domain S and quantifiers.

(a) Not all students have MSC degree.

(b) No student with GPA less than or equal to 3.0 has MSC degree.

(c) It is a necessary condition for having MSC degree is to have a GPA greater than 3.0.

(d) A student will not have MSC degree whenever his/her GPA is not greater than 3.0.

Q4. [8 marks] Let $W(x, y)$: " x wears y ", X , is the set of all students, and Y , is the set of all items.
 Assume that $X = \{ahmed, kareem\}$ and $Y = \{hat, glasses, watch\}$.

Also assume that ahmed wears a hat and a watch and kareem wears a glasses and a watch.

For each of the following statements write it in English and find its truth value.

(a) $\forall y : W(Ahmed, y)$

☐ True ☐ False In English:

(b) $\exists x : W(x, Glasses)$

☐ True ☒ False In English:

(c) $\forall x \exists y : W(x, y)$

☐ True ☐ False In English:

(d) $\neg \exists x \forall y : W(x, y)$

☐ True ☐ False In English:

a)-----

b)-----

c)-----

d)-----

Q5. Consider the following argument (without a conclusion).

I heard the cat meow and I saw it not running. If the cat is not in the basement, then it is not in the the bed room. The cat is not in the basement unless I saw it running. The cat is in the bed room or the cat foot prints are seen on the floor. If the cat foot prints are seen on the floor, then the cat is under the bed.

(a) [2 marks] Convert the above argument into symbolic form. Use the symbols:

m: I heard the cat meow

r: I saw the cat running

(b) The cat is in the bed room

(s) The cat is in the basement

(p) the cat foot prints are seen on the floor

(u) The cat is under the bed

(b) [6 marks] Where is the cat? Justify your answer.